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Preliminary Observations on the Pond Culture of Meagre, *Argyrosomus regius* (Asso, 1801) (Sciaenidae) in Egypt

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Abstract: The present study was carried out to assess the potential of the meagre, *Argyrosomus regius* for brackish-water pond aquaculture without supplementary feeding in the Mediterranean area near Damietta City, Egypt during June, 2004 to July, 2005. Fingerlings *A. regius* of mean length 11.92 cm and 17.7 g weight were stocked in brackish-water pond measuring 10 feddans and 1.25 m deep. Stocking was done at a rate of 2000 fish feddan^{-1} in a polyculture system including tilapia and sardine and fed mainly on natural occurring prey (natural spawned tilapia) and small shrimp. At the end of the culture period, the gross weight of the harvested meagre was measured and the net pond production calculated by the difference between weight stocked and weight harvested. Temperature varied from 14.8 to 32.4°C; pH, 7.1 to 8.3; Dissolved Oxygen (DO), 5.8 to 8.2 mg L^{-1} and salinity, 18.2 to 5.5 psu during the study. Meagre, *A. regius* attained a length ranges 26.2 to 35.8 cm with an average 29.3 cm fish^{-1} and weight ranges 887 to 1370 g with an average of 1014 g fish^{-1} at harvest with an increment of 996.3 g fish^{-1} and a daily gain of 2.55 g fish^{-1}. Survival rate ranged from 84% and net production was 1668.1 kg feddan^{-1}. This experiment demonstrated the possibility of cultivation of *A. regius* as well as the higher commercial value where better net return (23163 LE feddan^{-1}) was recorded with investment return of 3.09/1.0 LE cost. The results of the study indicated meagre as a promising candidate for the brackish water pond aquaculture.

Key words: Meagre, *Argyrosomus regius*, brackish-water fish pond, Egypt

INTRODUCTION

The meagre *Argyrosomus regius* (Asso, 1801), is a sciaenid widely found in the Mediterranean and Black Sea and along the Atlantic coasts of Europe and the west coast of Africa (Poli *et al*., 2003). It is one of the most and valuable commercial finfish and greatly appreciated by consumers of sea products. This fish has been known for centuries to produce sounds (Lagardere and Mariani, 2006). The Sciaenidae is among the largest families of sonic fishes, comprising some 150 species within 30 genera (Chao, 1986). Among these species, *A. regius* is a good candidate for the diversification of

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national aquaculture for its good quality of flesh (Fasano *et al*., 2006). This fish lives in inshore and shelf waters, close to the bottom or near the surface with depth range 15-200 m and it also enters estuaries and coastal lagoons (Poli *et al*., 2003). The fish can reach over 50 kg in the wild, the largest size recorded being 182 cm total length and 103 kg of body weight (Quéro and Vayne, 1987). It is an important sea food in the Bay of Biscay and along the coast of Senegal and Mauritania (Quéro, 1989). This fish is highly appreciated by the consumers for its royal quality of flesh (Poli *et al*., 2003).

A wide variety of production systems such as cages, ponds, tanks and raceways are being used for aquaculture in agriculture, freshwater and marine environments in Egypt (Jamu and Ayinla, 2003). In Egypt, aquaculture is concentrated on inland farms, with the main species culture being tilapia and mullets. However, high productivity of these systems has led to over supply of the two species, with consequent decline in market prices. Hence, there is a need to investigate new species amenable for culture under the existing conditions as a strategy for diversifying market opportunities for the cultured species in Egypt and the whole world as well. Recently an experiment has been carried out on the pond aquaculture of European eel *Anguilla anguilla* in the earthen pond without supplementary feeding at Lake Manzala, Egypt (El-Shebly *et al*., 2007). However, meagre is a fast growing species with a good taste and has a tremendous potential for culture in brackish water ponds (FAO, 2002). Commercial farming of this species is still in its infancy due to non-availability of its seed in adequate quantities and the absence of a viable culture technology. Moreover, Sadek and Baraneya (1993) referred to the importance of the area at Damietta City in marine culture where brackish water fish farms are widely distributed. Earlier, Gracia *et al*. (2002) recorded that meagre grow very fast in the cages in brackish water ponds in Egypt.

Feed expenditure constitute 30-70% of total expenditure in fish culture and for this reason different methods have been essayed to gain benefit from every kind of feed source especially in the countries with developed aquaculture sector (Hossain *et al*., 2007). The overall goal of the aquaculture is to reduce production costs, maximize production and increase profitability (Hossain *et al*., 2007).

To the best of the author's knowledge, at present, a few attempts have been made at farming this species in the world (FAO, 2002). Poli *et al*. (2003) reported that just one French farm (Les Poissons du Soleil), with hatchery, nursery and on growing facilities, has succeeded in the artificial reproduction and rearing of meagre. Recently, just two French and two Italian marine farms have intensively grown fry up to market sizes (FAO, 2002). This present study was carried out to assess the potential of the meagre, *A. meagre* for culture under the existing conditions in the brackish-water without use of supplementary feeding, under earthen pond systems in Egypt.

MATERIALS AND METHODS

Study Site and Experimental Units

The experiment was done in collaboration with a private fish farm located at Damietta Governorate with an area of 10 feddans and a water depth of about 12.5 m during June, 2004 to July, 2005. The water in this farm is a brackish due to the mixing of Mediterranean Sea waters and waters from Lake Manzala. Productivity was based on the natural productivity of the ponds hence the experimental ponds were kept free from any shading through out the day. Sampling for physico-chemical parameters was done once a week between 09.00 and 12:00 h from specific points of the pond at a depth of 20-30 cm below the surface. A mercury thermometer was used to measure water temperature (°C), while salinity (psu) was measured with a salinometer. Digital electronic meters (Model YSI-58, USA and Jenway Model-3020) were used to measure Dissolved Oxygen (DO) (mg^{-1}) and pH on site, respectively, according to the standard procedures and methods as defined in APHA (1992).

Fish Stocking and Sampling

The fingerlings of meagre (*A. regius*) were obtained from the coastal area of Mediterranean Sea and Northern shores of Lake Manzala, during June, 2004 with an average initial body weight of 17.7 g fish^{-1} and average initial lengths of 11.92 cm fish^{-1}. The pond was stocked with the fingerlings of meagre *A. regius* at the rate of 2000 fish feddan^{-1}. Before stocking *A. regius* fingerlings, the experimental pond was stocked with sardine and tilapia in polyculture systems to provide nutrition for the cultured meagre, preying the occurring prey of spawned tilapia and sardine fingerlings in the ponds. Additional feeding supplement was done with wild collected *Tilapia zillii* and small shrimps of the *Palaemon* spp.

Thirteen random samples of the fish were taken during the study period (12 samples year^{-1}), where 15-20 fingerlings meagre were randomly sampled monthly. The samples were measured for weight and length to the nearest 0.01 g and 0.01 cm, respectively.

At the end of experiment, the pond was harvested and a complete census of all meagre done, where all the harvested individuals were counted; weighed and length measurements taken. To ensure complete harvest, the meagre were harvested initially by netting and any remaining individuals harvested by complete draining of the earthen ponds and hand picking any meagre in the ponds.

Fish growth, expressed as daily increment in weight (g fish^{-1}) or the increase in body weight per day (% day^{-1}) was calculated based the following formula:

$$DGR = (W_2 - W_1)/t$$

Where,

W_1 = The initial live body weight (g),
W_2 = The final live body weight (g),
t = The time in days.

Survival rates (%) were estimated as: No. of fish harvested/No. of fish stocked×100. Net production (kg feddan^{-1}) was calculated by deducting the biomass stocked from the biomass harvested.

The mean fish weight (g) was determined in terms of gain in weight:

$$GW = (W_2 - W_1)/W_1 \times 100$$

Where,

W_1 = The initial live body weight (g),
W_2 = The final live body weight (g).

The condition factor (CF) is determined according to the equation:

$$CF = (W/L3) \times 100$$

Where,

W = The body weight (g),
L = The length of the fish (cm).

A simple economic analysis was performed to estimate the profitability from this experiment. Total investment costs were calculated and the net revenue was determined by the difference between the gross revenue and the total investment costs. This analysis was based on farm gate prices of meagre and current local market prices expressed in Egyptian LE.

Statistical Analysis

Variations in physico-chemical parameters and growth data were tested by using one-way ANOVA and any difference at 5% level of significance using the Tukey test.

RESULTS

Physico-Chemical Parameters

Mean values of some water quality parameters such as temperature, pH, dissolved oxygen and salinity were calculated to provide an overview of changes in the meagre culture earthen pond during the experimental period as shown in Table 1. Water temperature varied from 14.8 to 32.4°C with an average of 23.7°C during the study depending upon environmental variation. There were significant variations in temperatures among the months during this study ($p<0.05$). The water pH varied from 7.1 to 8.3 with an average of 7.5 and Dissolved Oxygen (DO) content varied from 5.8 to 8.2 mg L^{-1} with an average of 7.5 mg L^{-1}. Water salinity ranged from 13.0 to 18.2 psu with an average of 14.8 psu depending upon the tide in the lake, drainage water discharged into the lake and the seasonal variations. The variations of pH and dissolved oxygen were more or less similar ($p>0.05$) among the months and within the productive range, although the variations in salinity was significantly ($p<0.05$) different.

Growth and Production of Meagre

The growth performance of the *A. regius* in terms of initial weight, final weight, initial total length, final total length, stocking rate, survival rates, daily increment in weight and total production are shown in Table 2.

The fish attained an average final weight of 1014 g $fish^{-1}$ and an average final length of 29.3 cm $fish^{-1}$ at the end of the rearing period (390 days). The fish attained an increment in weight of 996.3 g $fish^{-1}$ with daily gain of 2.55 g $fish^{-1}$ and a percentage gain in weight of 5628.8 $fish^{-1}$.

The survival rate was 84%. The total production was 1703.5 kg $feddan^{-1}$ with net production of 1668.1 kg $feddan^{-1}$. The food conversion ratio (kg food per kg fish produced) was 3:1. The average Condition Factor (CF) value for individual fish was 4.03.

To show the economical value of fish culture, some economical aspects has been taken into consideration: 1) The production, 2) The cost of culturing, 3) The quality and size of the fish for marketing. The economic evaluation (Table 3) showed that the costs of culturing $feddan^{-1}$ was 1500 LE. for the fingerlings price (0.75 LE per unit), 5000 LE for food (5000 kg fresh fish $feddan^{-1}$)

Table 1: Water quality variables measured in the experimental brackish-water fish farm at Damietta, Egypt during June, 2004 to July, 2005

Parameters	Range	Average
Temperature (°C)	14.8-32.4	23.7
pH	7.1-8.3	7.5
Dissolved oxygen (mg L^{-1})	5.8-8.2	6.3
Salinity (psu)	13.0-18.2	14.8

Table 2: Growth performance of the meagre, *Argyrosomus regius* reared in brackish water fish farms at Damietta, Egypt during June, 2004 to July, 2005

Parameters	Rate
Average initial weight (g $fish^{-1}$)	17.7±8.3
Average final weight (g $fish^{-1}$)	1014±238
Average initial length (cm $fish^{-1}$)	11.92±2.7
Average final length (cm $fish^{-1}$)	29.3±6.4
Stocking density (fish $feddan^{-1}$)	2000
Survive rate (%)	84
Rearing period (day)	390
Total weight at stocking (kg $feddan^{-1}$)	35.4
Total weight at harvest (kg $feddan^{-1}$)	1703.5
Net production (kg $feddan^{-1}$)	1668.1
Gain in weight (g $fish^{-1}$)	996.3
Gain in weight (%)	5628.8
Daily gain in weight (g $fish^{-1}$)	2.55
Food intake (kg $feddan^{-1}$)	5000
Food conversion	3
Condition Factor (CF)	4.03

Table 3: Cost-benefit analysis and net return LE feddan^{-1} of meagre, *Argyrosomus regius* reared in brackish-water fish farms at Damietta, Egypt during June, 2004 to July, 2005

Items	Rate
Costs feddan^{-1}	
Fingerlings costs LE^{-1}	1500
Feed cost	5000
Labour and other costs	1000
Total costs LE feddan^{-1}	7500
Income feddan	
Total production (kg feddan^{-1})	1703.5
Price (LE) of one kg fish	18
Total income, LE feddan^{-1}	30663
Net return, LE feddan^{-1}	23163
Investmental return, LE return LE^{-1} cost	3.09

and 1000 LE for other costs. The total cost was 7500 LE feddan^{-1}. The total production was 1703.5 kg feddan^{-1} (Table 3) with total income of 30663 LE feddan^{-1} (18 LE Kg^{-1}). The net return was 23163 LE feddan^{-1} with the investment return of 3.09 LE for each 1.0 LE cost.

DISCUSSION

The possibilities of cultivation of meagre (*A. regius*) in the Mediterranean area in brackish water fish farms near Damietta city, Egypt has been observed by this experiment. Earlier, Sadek and Baraneya (1993) referred to the importance of the area at Damietta city in marine culture where marine and brackish water fish farms are widely distributed. The modern trials for rising meagre in cages have been conducted by Gracia *et al*. (2002) and they found that meagre grow very fast in cages. Recently El-Shebly *et al*. (2007) recorded the good findings from his experiment on the pond aquaculture of European eel *A. anguilla* in the earthen pond without supplementary feeding at Lake Manzala, Egypt.

The variations of water temperatures are attributed to weather conditions and statistical tests showed significantly differences ($p<0.05$) in temperatures among the month during the study. The observed average temperatures were within the optimal ranges (14.3-32.4°C) for fish production in tropical ponds (Begum *et al*., 2003; Hossain *et al*., 2006). However, the best temperature for the growth of meagre is between 17-21°C and feeding activity is substantially reduced when water temperatures drop below 13-15°C (FAO, 2002). Quemener (2002) also has been recorded the similar findings that the rapid growth of meagre, *A. regius* was between 16 and 20°C. On the other hand, Boyd (1992) recommends optimal temperature for fish culture, in the range 26.06-31.97°C, if fish growth and consequently yields are to be optimized. It should also be indicated that temperature alone may not account for variations in plankton as well as fish production, other factors such as high pH, alkalinity, carbon dioxide and nutrients are also responsible for the organic production (Pulle and Khan, 2003; Hossain *et al*., 2007; Begum *et al*., 2007). The variations in pH and dissolved oxygen were similar ($p>0.05$) and within the productive range (Wahab *et al*., 1994; El-Shebly *et al*., 2007; Hossain *et al*., 2007), although the variations of salinity was significantly ($p<0.05$) difference among the month. In this study, the fluctuation in water salinity was dependent on percentages of mixing of sea water and Lake Manzala water (El-Hehyawi, 1974). And also it was controlled by wind direction and tides.

The rapid development of aquaculture for global food security is gaining importance. This trend has led to intensification and diversification of aquaculture activities. The meagre is one of the most valuable commercial fish for aquaculture (Poli *et al*., 2003). The present study deals with the possibilities of cultivation of meagre in earthen ponds without any supplementary feeding in Egypt.

The present results recorded survival rate of 84% at the end of thirteen month culture period. This higher survival rates was partly because of the favorable conditions and the good water quality, beside the average initial weight and length which were high (17.7 g and 29.3 cm).

During the study, it has been recorded an average individual length of 29.3 cm and average individual weight of 1014 g for thirteen months culture period. Risk and Hashem (1981) recorded a length of 28 cm after the first year culture under the Egyptian conditions. Osman and Sadek (2002) recorded an individual weight of 724.5 g fish^{-1} in 300 days for meagre. The present results were better than the findings recorded by Risk and Hashem (1981) and Osman and Sadek (2002).

This fish were fed on small fresh shrimp, sardine and *Tilapia zillii* which contain a high content of protein. Earlier it was reported that meagre primarily feed on schooling fish such as sardine (Cabral and Ohmert, 2001). Further, Quero and Vayne (1985) reported that in wild, the young meagre (*A. regius*) feed on small crustaceans and the adults on pelagic fishes. The optimum growth and feed efficiency of marine fish can be achieved by providing large amounts of protein (40-60%) in the diet (Metailler *et al*., 1981; Hidalgo *et al*., 1988; Tulli and Tibaldi, 1989; Tibaldi and Lanari, 1991). In general, marine fish require higher dietary protein diets than other fishes. Peres and Oliva-Teles (2003) recorded that the reduction of dietary protein level not only affect growth rate but also increased feed intake and decreased feed efficiency for marine fish. During this study, it was recorded the food conversion ratio was 3:1.

The daily gain in weight in the present study was 2.55 g fish^{-1}. The highest daily gain of meagre was recorded from the same area where other marine fishes such as Sea bream (*Sparus aurata*) attained a daily gain of 0.73 g fish^{-1} (El-Shebly and Siliem, 2003) and Sea bass (*Dicentrarchus labrax*) attained a daily gain of 1.13 g fish^{-1} (El-Shebly, 2005).

The present net production was 1668.1 kg feddan^{-1} which was higher (two times) than the findings by Sadek (1997) who recorded a production of 706 kg feddan^{-1} and by Osman and Sadek (2002), where they recorded a total production of 520 kg feddan^{-1} for the same fish in Egypt. The first commercial production for this fish was recorded in 1997 in France (FAO, 2002). Since then production has expanded slowly in nearby regions, especially on the Tyrrhenian side of the Italian coast and in Corsica (FAO, 2002). The adult meagre market is now slowly expanding, especially in Italy; this could promote fry production in the future, as well as research on fry and juvenile production (FAO, 2002). Production of farmed meagre is very limited so far and is confined to the Mediterranean Basin (southern France, Corsica and Italy) (FAO, 2002). Reported production in 2002 was 231 tons (50% from Italian cages; 7% from Italian tanks; 40% from French cages; 3% from French tanks) with a value of US$ 1.55 million (FAO, 2002).

Fish meal is the main component of majority of artificial fish feeds and one of the most expensive ingredients in the manufacture of artificial feeds, consequently increasing the overall costs of fish production (Altun *et al*., 2005). During this study the strategy of aquaculture without any artificial feeds has been developed in Egypt, where the artificial fish meal unavailable and expensive. However, it is obvious that in addition to artificial feed discarded fish and fish wastes from the local fish markets may be utilize to improve the aquaculture strategy of meagre in Egypt. Poultry wastes may also be used as artificial feeds. However, during this study, the net return was 23163 LE feddan with the investment return of 3.09 LE for each 1 LE cost.

Fish culture gives higher returns in money and food than rising of cattle, sheep and poultry (Hickling, 1962). The result of the present study has been shown the higher production of meagre and accordingly the higher income which means that investment in this field of production is profitable. Finally, the present study concluded that meagre may be a promising candidate for the brackish water pond aquaculture in Egypt as well as other parts of the world.

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REFERENCES

Altun, T., N. Tekelioglu, E. Nevsat and Y. Sagat, 2005. Some growth parameters on European eel (*Anguilla anguilla* L., 1758) fed with different feeds. E.U. J. Fish. Aqua. Sci., 22: 215-219.

APHA., 1992. Standard methods for the examinations of water and wastewater. American Public Health Association, 1015, 18th Street, New York, Washington, D.C. 20036, pp: 874.

Begum, M., M.Y. Hossain, M.A. Wahab and A.H.M. Kohinoor, 2003. Effects of iso-phosphorus fertilizers on water quality and biological productivity in fish pond. J. Aqua. Trop., 18: 1-12.

Begum, M., M.Y. Hossain, M.A. Wahab, Z.F. Ahmed, M.J. Alam, M.M.R. Shah and S. Jasmine, 2007. Effects of iso-nutrient fertilization on plankton production in earthen ponds of Bangladesh. Pak. J. Biol. Sci., 10: 1221-1228.

Boyd, C.E., 1992. Water Quality Management of Pond Fish Culture. Elsevier Sci. Publ. Co. Amsterdam-Oxford, New York, pp: 318.

Cabral, H.N. and B. Ohmert, 2001. Diet of the Juvenile meagre (*Argyrosomus regius*), within the Tagus estuary. Cahiers-de-Ecologie Marine, 24: 289-293.

Chao, L.N., 1986. Sciaenidae, in fishes of the northern-eastern atlantic and the mediterranean UNESCO, Paris, pp: 865 874.

EL-Hehyawi, M.L.E., 1974. Changes in salinity and landings of six species in the shelf, North to the Nile Delta. Bull. Inst. Oceanography Fish., Egypt, 4: 435-458.

El-Shebly, A.A. and N.A. Siliem, 2003. Studies on growth and production of sea bream *Sparus aurata* in brackish water fish farms. Bulletin National Institute of Oceanography and Fisheries, A.R.E., 29: 267-279.

El-Shebly, A.A., 2005. Studies on growth and production of sea bass (*Dicentrarchus labrax*) reared in brackish water fish farms. J. Egypt. Acad. Soc. Environ. Develop. (B-Aquaculture), 6: 19-30.

El-Shebly, A.A., M.A.H. El-Kady and M.Y. Hossain, 2007. A Preliminary observation on the pond culture of European eel, *Anguilla anguilla* (Linnaeus, 1758) in Egypt: Recommendations for future studies. Pak. J. Biol. Sci., 10: 1050-1055.

FAO (Food and Agricultural Organization), 2002. Cultured aquatic species information programme *Argyrosomus regius*. (http://www.fao.org/fi, accessed date: 7 May, 2007).

Fasano, P., L. Zilli, S. Vilella and L.D.F. Comparata, 2006. Assessing genetics diversity of a *Argyrosomus regius* stock using amplified fragment length polymorphism analysis. AQUA 2006: 1- 2. (World Aquaculture Meeting Abstract).

Gracia, F., A. Jofer, E. Pascual, Y. Sanchez and S. Rey, 2002. Preliminary studies on growth of meagre, *Argyrosomus regius* (Asso, 1810) in sea cages and indoor tanks. Aquaculture Europe, 2002, Sea Farming Today and Tomorrow, pp: 422-423.

Hidalgo, N., A. Allial and W. Thebault, 1988. Influence of water temperature on protein in requirements and protein utilization in juvenile sea bass (*Dicentrarchus labrax*). Aquaculture, 72: 115-129.

Hossain, M.Y., M. Begum, Z.F. Ahmed, M.A. Hoque, M.A. Karim and M.A. Wahab, 2006. A study on the effects of iso-phosphorus fertilizers on plankton production in fish ponds. South Pacific Studies, 26: 101-110.

Hossain, M.Y., S. Jasmine, A.H.M. Ibrahim, Z.F. Ahmed, J. Ohtomi, B. Fulanda, M. Begum, A. Mamum, M.A.H. El-Kady and M.A. Wahab, 2007. A preliminary observation on water quality and plankton of an earthen fish pond in Bangladesh: Recommendations for future studies. Pak. J. Biol. Sci., 10: 868-873.

Jamu, D.M. and O.A. Ayinla, 2003. Potential for the development of aquaculture in Africa. NAGA, 26: 8-13.

Lagardere, J.P. and A. Mariani, 2006. Spawning sounds in meagre *Argyrosomus regius* in the Gironde estuary. France. J. Fish. Biol., 69: 1697-1708.

Metailler, L., F. Aldrin, H. Messager, M. Movel and G. Stephan, 1981. Feeding of European sea bass, *Dicentrarchus labrax*: Role of protein and energy sources. J. World Maricult. Soc., 12: 117-118.

Osman, M.F. and S. Sadek, 2002. Meagre (*Argyrosomus regius* Asso, 1801) A new candidate in Aquaculture (short notes): 1st Scientific Conference of the Egyptian Aquaculture Society, Faculty of Environmental Agricultural Sciences, El-Arish, North Sinai, Egypt, pp: 7.

Peres, H. and A. Oliva-Teles, 2003. The effect of dietary ribonucleic acid incorporation in performance of European sea bass (*Dicentrarchus labrax*) juvenile. Aquaculture, 215: 245-253.

Poli, B.M., G. Parisi, G. Zampacavallo, F. Iurzan, M. Mecatti, P. Lupi and A. Bonelli, 2003. Preliminary results on quality and quality changes in reared meagre (*Argyrosomus regius*): Body and fillet traits and freshness in refrigerated commercial-size fish. Aquacult. Int., 11: 301-311.

Pulle, J.S. and A.M. Khan, 2003. Phytoplanktonic study of Isapur Dam Water. Eco. Environ. Cons., 9: 403-406.

Quemener, L., 2002. Meagre (*Argyrosomus regius*): Biology, Fisheries, market and rearing potential. Resources-de-La-mer-Ifremer Plouzane-France, pp: 31.

Quero, J.C. and J.J. Vayne, 1985. The mearge (*Argyrosomus regius*) from the Bay of Biscay and farm more septentional waters. Rev. Trav. Peches-Marit., Nantes, 49: 35-66.

Quero, J.C. and J.J. Vayne, 1987. The meagre, *Argyrosomus regius* (Asso, 1801) (Pisces, Perciformes, Sciaenidae) from Gulf of Gascony and some more Northern waters. Magazine of Jobs of the Institute of Maritime Peches, 49: 35-66.

Quero, J.C., 1989. The meagre *Argyrosomus regius* (Pisces, Scianide) from the Western Mediterranean. Bull. Soc. Zool., 114: 220-227.

Risk, M.H. and M.T. Hashem, 1981. Some biological aspects of *Sciacna aquilla* Risso in Abu-Kir Bay. Bulletin Institute Oceanography Fisheries, A.R.E., 7: 505-516.

Sadek, S. and A. Baraneya, 1993. Evaluation of Egyptian trial in aquaculture. Fish Culture Workshop. Riyadh, Saudi Arabia, pp: 27.

Sadek, S.S., 1997. Effect of some environmental factors on growth rate and production of *Epinephalus guaza* and *Argyrosomus regius*. Fish. Resour., 15: 8 (In Arabic).

Tibaldi, E. and L. Lanari, 1991. Optimal dietary lysine levels for growth and protein utilization of juvenile sea bass *Dicentrarchus labrax* fed semi-purified diets. Aquaculture, 95: 297-304.

Tulli, F. and E. Tibaledi, 1989. Influence of dietary energy/protein ratio on growth of juvenile sea bass *Dicentrarchus labrax*. Zootec. Nutr. Anim., 15: 4008-4015.

Wahab, M.A., M.T. Islam, Z.F. Ahmed, M.S. Hoque, M.A. Hoque and B.K. Biswas, 1994. Effects of frequency of fertilizers on the pond ecology and growth of fishes. BUA Res. Prog., 9: 410-419.